United States
Environmental Protection
Agency

SUPERFUND INNOVATIVE
TECHNOLOGY EVALUATION

Demonstration Bulletin

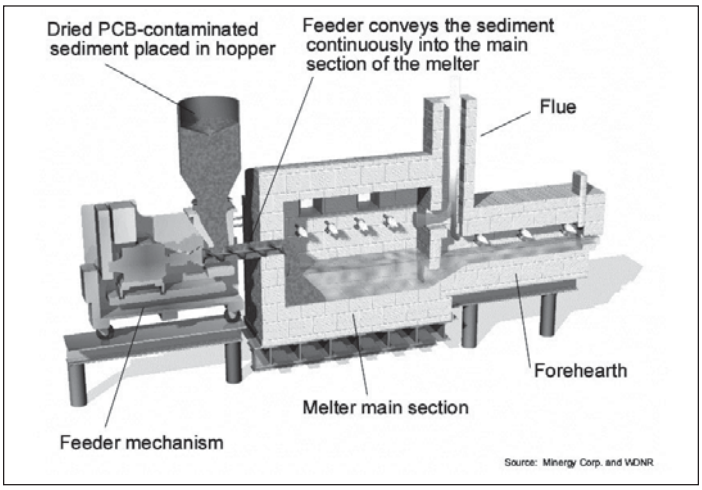
Minergy Glass Furnace Technology

Minergy Corporation

Technology Description: The Glass Furnace Technology (GFT) was developed by Minergy Corporation (Minergy), of Waukesha, Wisconsin. Minergy originally developed vitrification technologies to process paper mill sludge into glass aggregate that could be sold as a commercial product. Minergy modified a standard glass furnace to melt and treat river sediment containing polychlorinated biphenyls (PCBs). The technology was evaluated during a U.S. Environmental Protection Agency Superfund Innovative Technology Evaluation (SITE) Program demonstration at the Minergy facility in Winneconne, Wisconsin, in August 2001. The SITE program evaluated the technology's ability to treat sediment containing PCBs and metals to form a product with beneficial reuse. Because the GFT melter requires the river sediment to be greater than 90 percent solids prior to loading it into the melter, the SITE program also evaluated a bench-scale dryer technology as a secondary activity. The sediment for this evaluation was dredged from the Lower Fox River, dewatered, and filter-pressed. The PCB concentration of sediment fed into the GFT unit ranged up to 36 parts per million (ppm) by weight.

In the GFT process, dried sediment is fed into the GFT hopper above the feeder mechanism. The feeder conveys the sediment continuously into the main section of the melter. At the furnace temperature of 2,900° Fahrenheit, the sediment's organic portion is destroyed, and the inorganic portion does not burn, but melts, forming molten glass. The molten glass flows through the furnace into the forehearth, where it is stabilized. That glass then flows through an opening at the end of the forehearth and drops into a water-filled quench tank. Exhaust gases flow from the furnace through a flue. For the demonstration, air-sampling equipment extracted glass-furnace emissions from this flue for laboratory analyses.

Minergy claims that the GFT process offers advantages over incineration and other vitrification technologies. An incinerator would require large quantities of fuel for treatment of low-organic-content sediments. In addition, typical waste incineration generates large amounts of ash that require landfilling. Unlike other vitrification technologies, GFT is designed to melt materials that have no fuel value. Other vitrification systems typically require very high energy consumption. GFT is based on commercial glass-making technology, which operates in a more energy efficient manner. The GFT uses oxy-fuel burners, combining natural gas and purified oxygen to create intense flames above the glass pool.



Waste Applicability: Minergy claims that the GFT process is capable of treating PCB-contaminated sediment containing inorganic contaminants, including mercury. Sediment contamination is a relatively common problem throughout the Great Lakes Basin, with sediment removal generally being the most common remediation method. Currently, the public, particularly on a local scale, is reluctant to accept placing PCB- and mercury-contaminated sediments in landfills. The public has also expressed a desire to further explore remediation technologies that remove or destroy contaminants whenever possible. The GFT potentially can help address the problem of landfilling contaminated dredge materials. Providing environmentally acceptable and cost-effective disposal of contaminated sediment would allow for more publicly acceptable and effective cleanups.

Demonstration Approach: This technology was evaluated during two sampling events: (1) an event associated with the operation of the bench-scale dryer, conducted January 24 to 28, 2001; and (2) an event associated with the operation of the melter, conducted August 14 to 17, 2001. The bench-scale dryer evaluation involved sampling and analysis of the sediment prior to and after drying, as well as sampling and analysis of effluent gas and condensate water generated in the drying process. The melter evaluation involved sampling and analysis of sediment prior to

melting, glass aggregate product generated, quench water, and furnace exhaust. System operating conditions were monitored during both events.

The primary objectives of the SITE demonstration were:

- **To determine the treatment efficiency (TE) of PCBs in dredged-and-dewatered river sediment when processed in the Minergy GFT.**
- **To determine whether the GFT glass aggregate product meets the criteria for beneficial reuse under relevant federal and state regulations.**

In addition, the following secondary objectives were intended to provide additional information that will be useful in evaluating the technology.

- **Determine the unit cost of operating the GFT on dredged-and-dewatered river sediment.**
- **Quantify the organic and inorganic contaminant losses resulting from the drying process.**
- **Characterize organic and inorganic constituents in all GFT process input and output streams.**

Demonstration Results: The preliminary results of the demonstration are summarized in the table. The bench-scale dryer was evaluated by sampling and analyzing composite samples of sediment before and after the drying process. This evaluation was designed to determine the amount, if any, of contaminants lost during the drying process. Concentrations of mercury going into the dryer averaged 0.92 ppm. Post-drying mercury levels averaged 0.87 ppm. During the demonstration, the glass furnace processed about 200 pounds of dried sediment per hour for 122 consecutive hours, processing a total of 25,800 pounds of dried sediment and generating about 16,200 pounds of glass aggregate product. PCB and mercury concentrations of sediment fed into the system during the evaluation averaged 28.1 ppm and 0.72 ppm, respectively. PCB and mercury concentrations in the glass aggregate product were below laboratory method detection limits.

Key findings from the demonstration, including complete analytical results, operating conditions, and a cost analysis, will be published in an Innovative Technology Evaluation Report.

Preliminary Treatment Efficiency Calculations Table (Solids Only)

Sampling Event	Compound	Average Inlet Concentration (ppm)	Average TE (%)
Bench-scale Dryer	PCBs	1.49*	10.1
	Mercury	0.92	5.4
Melter	PCBs	28.1	>99.9
	Mercury	0.72	>65

*Average dryer concentration based on a subset of 20 congeners.

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